EE325 HW 6 (Multicollinearity, Heteroscedasticity, and Autocorrelation)

Multicollinearity

1. State with reason whether the following statements are true, false, or uncertain:
    a. Despite perfect multicollinearity, OLS estimators are BLUE.
    b. In cases of high multicollinearity, it is not possible to assess the individual significance of one or more partial regression coefficients.
    c. High pair-wise correlations do not suggest that there is high multicollinearity.
    d. You will not obtain a high R-squared value in a multiple regression if all the partial slope coefficients are individually statistically insignificant on the basis of the usual t-test.
    e. Ceteris Paribus, the higher the VIF is, the larger the variances of OLS estimators.

Empirical Exercises (STATA exercise) ☺☺

2. Table 10.3 gives data on import, GDP, and the Consumer Price Index (CPI) for the United States over the period 1975-2005. You are asked to consider the following model:

$$\ln imports_t = \beta_1 + \beta_2 \ln GDP_t + \beta_3 \ln CPI_t + u_t$$

    a. Estimate the parameters of this model using the data
    b. Do you suspect that these is multicollinearity in the data?
    c. Regress:

$$(1)\ \ln imports_t = A_1 + A_2 \ln GDP_t$$
$$(2)\ \ln imports_t = B_1 + B_2 \ln CPI_t$$
$$(3)\ \ln GDP_t = C_1 + C_2 \ln CPI_t$$

    On the basis of these regressions, what can you say about the nature of multicollinearity in the data?

    d. Suppose there is multicollinearity in the data but $\hat{\beta}_2$ and $\hat{\beta}_3$ are individually significant at the 5 percent level and the overall F-test is also significant. In this case should we worry about the collinearity problem?

Heteroscedasticity

3. State with brief reason whether the following statements are true, false, or uncertain
    a. In the presence of heteroscedasticity OLS estimators are biased as well as inefficient.
    b. If heteroscedasticity is present, the conventional t and F tests are invalid
    c. In the presence of heteroscedasticity the usual OLS method always overestimates the standard errors of estimators.
    d. If residuals estimated from an OLS regression exhibit a systematic pattern, it means heteroscedasticity is present in the data

Empirical Exercises (STATA exercise) ☺☺

4. Table 11.7 gives data on 81 cars about MPG (average miles per gallons), HP (engine horsepower), VOL (cubic feet of cab space), SP (top speed, miles per hour), and WT (vehicle weight in 100 lbs)

    a. Consider the following model:

    $$MPG_i = \beta_1 + \beta_2 SP_i + \beta_3 HP_i + \beta_4 WT_i + u_i$$

    Estimate the parameters of this model and interpret the results.

    b. Use the white test to find out if the error variance is heteroscedastic.

Autocorrelation

5. State whether the following statements are true or false. Briefly justify your answer
    a. When autocorrelation is present, OLS estimators are biased as well as inefficient.
    b. The Durbin-Watson d test assumes that the variance of the error term u_t is homoscedastic.
    c. The R-squared values of two models, one involving regression in the first-difference form and another in the level form, are not directly comparable.
    d. The exclusion of an important variable(s) from a regression model may give a significant d value.

Empirical Exercises (STATA exercise) ☺☺

6. Refer to the data on the copper industry given in table 12.7
    a. From these data estimate the following regression model:

    $$\ln C_t = \beta_1 + \beta_2 \ln I_t + \beta_3 \ln L_t + \beta_4 \ln H_t + \beta_5 \ln A_t + u_i$$

    Interpret the results.

    b. Estimate the Durbin-Watson d statistic and comment on the nature of autocorrelation present in the data